PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	10/812,406
Filing Date:	March 26, 2004
Applicant:	TAKASE et al.
Group Art Unit:	1742
Examiner:	MORILLO, Janelle Combs
Title:	WEAR-RESISTANT ALUMINUM ALLOY EXCELLENT IN CAULKING PROPERTY AND EXTRUDED PRODUCT...
Attorney Docket:	8498-000004/CO

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

AFFIDAVIT OF NOBUYUKI HIGASHI TRAVERSING REJECTION UNDER 37 CFR 1.132

Sir:

I, Nobuyuki HIGASHI, state as follows:

1. I graduated from Toyama University in 1985 with a bachelor's degree in Material Engineering.

2. In 1990, I started working for AISIN KEIKINZOKU CO., LTD. as an engineer in the Technical Development Department. My current position is Assistant Manager of Quality Group, Quality Assurance Department.

3. I am an inventor of the subject matter claimed in the above-identified patent application.

4. The claimed invention is directed to a wear-resistant aluminum alloy or extruded product that is excellent in caulking properties.

5. The composition of the alloy and extruded product of the claimed invention includes 0.1 to 0.39 wt% of Mg, 3.0 to 6.0 wt% of Si, 0.01 to 0.20 wt% of Cu, 0.01 to 0.5 wt% of Fe, 0.01 to 0.15 wt% of Mn, 0.01 to 0.5 wt% of Cr, less than 0.02 wt% of Zn, and the remainder being Al and unavoidable impurities.

6. The wear-resistant aluminum alloy and extruded product having the composition of paragraph 5 are suitable for use in automotive break parts for which wear resistance to sliding parts and viscosity during plastic deformation such as caulking are required.

7. To evaluate caulking properties of the alloy or extruded product, the calculation of a critical upsetting ratio may be used. The critical upsetting ratio occurs when microcracks develop during compression of the alloy or extruded product.

8. The critical upsetting ratio of the alloy and extruded product of the claimed invention is greater than or equal to 43%.

9. The composition of the claimed invention also satisfies the numerical expression $0.79 \cdot (\text{wt\% of Mn}) + 0.26 \cdot (\text{wt\% of Mg}) \leq 0.22$, which significantly affects the critical upsetting ratio as shown in Figure 4 of the present application.

10. The coefficients 0.79 (Mn) and 0.26 (Mg) were calculated using a multiple regression analysis of the relationship between the critical upsetting ratio as an evaluation item of caulking properties and the alloy components.

11. The critical upsetting ratio is significantly affected by the Mg content and the Mn content in the claimed ranges of 0.1 to 0.39 wt% and 0.01 to 0.15 wt%, respectively.

12. Reference Figure 1 (attached at Exhibit A) shows the relationship between the expression 0.79·(wt% of Mn)+0.26·(wt% of Mg) using the coefficients calculated using the multiple regression analysis and the critical upsetting ratio (%).

13. As can be seen in Reference Figure 1, the horizontal axis indicates the value of 0.79·(wt% of Mn)+0.26·(wt% of Mn), and the vertical axis indicates the critical upsetting ratio (%).

14. The plot numbers shown in Reference Figure 1 indicate Nos. 1 to 10 shown in Figure 1 of the present application, and supplemental data Nos. 11 to 18 as comparative examples.

15. The supplemental data Nos. 11 to 18 were selected from the ranges disclosed in the cited reference JP 09-176769 ('769).

16. Reference Figure 2, attached as Exhibit B, shows the alloy compositions and the critical upsetting ratios of the supplemental data Nos. 11 to 18.

17. As is clear form Reference Figure 1, alloy Nos. 1 to 6, 8 and 9 according to the claimed invention and the supplement data Nos. 11 to 18 (comparative examples selected from JP '769) clearly belong to different groups.

18. When the value indicated by the horizontal axis is x and the value indicated by the vertical axis is y, alloy Nos. 1 to 6, 8 and 9 according to the claimed invention belong to a first group approximated by $y = -100.46x + 65.55$ (R^2=0.84, linearly approximated statistically), and the supplemental data Nos. 11 to 18 belong to a second group approximated by $y = -13.40x + 43.68$ (R^2=0.50, almost linearly approximated statistically).

19. The minimum upsetting ratio of the alloys according to the claimed invention shown in Figure 1 is 43.1%. In this case, the value of 0.79xMn+0.26xMg is 0.22 (upper limit).

20. In contrast, the supplemental data Nos. 11 to 18 which were selected from JP'769 have a value of 0.79(wt% of Mn) +0.26(wt% of Mg) of more than 0.22, as shown in Reference Figure 1.

21. The supplemental data Nos. 16-18 contain a Mg content that is just slightly outside of the claimed range of 0.39 wt%.

22. Surprisingly, the critical upsetting ratio of the supplemental data Nos. 16-18 is less than 43%.

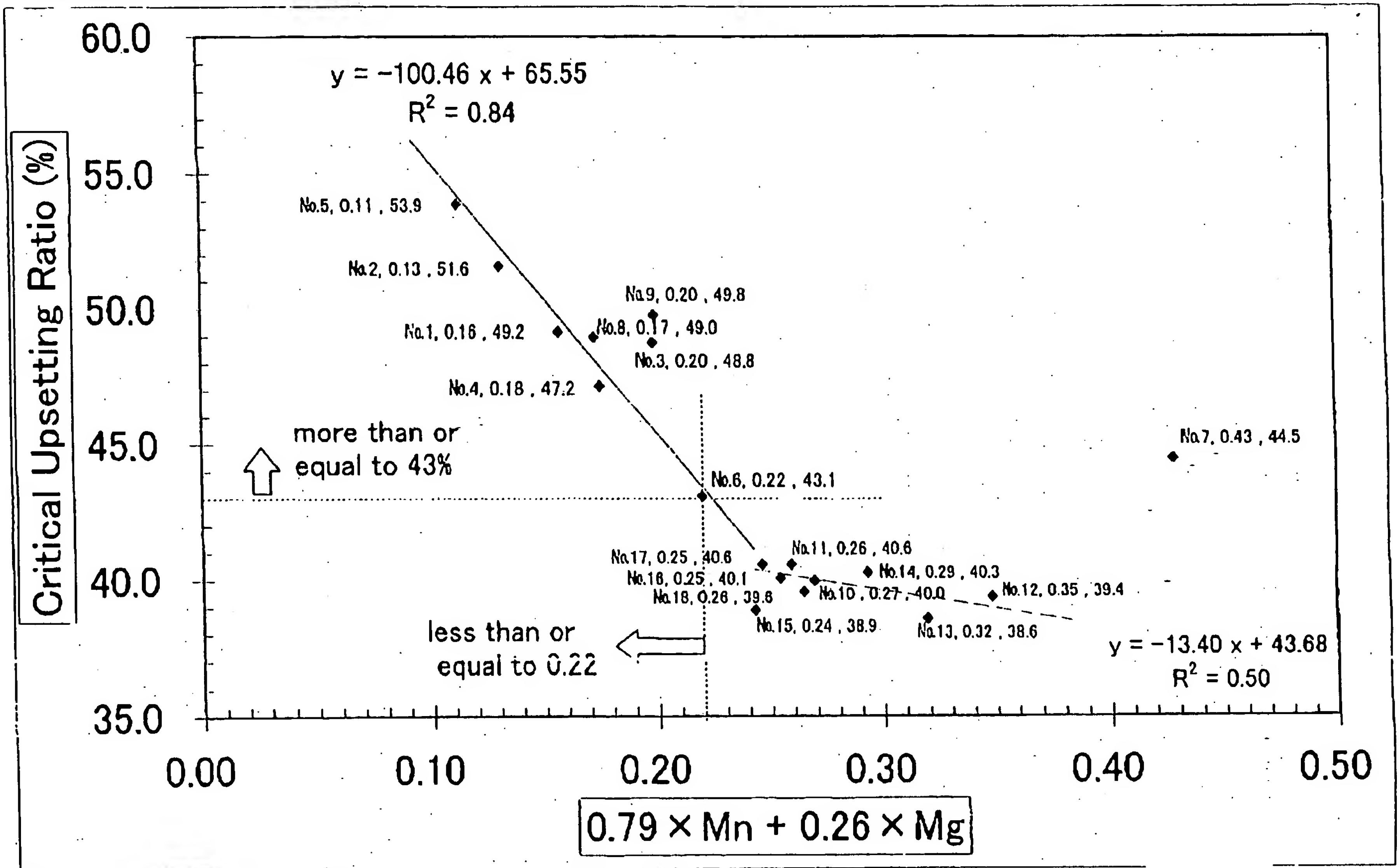
23. Quite unexpectedly, even though the comparative alloy Nos. 11 to 18 that were taken from the alloys disclosed JP '769, and in particular alloy Nos. 16-18 have a Mg content that is very close to the claimed range of 0.39 wt%, only the critical upsetting ratio of the claimed combination is greater than or equal to 43%.

Respectfully submitted,

Date: January 24, 2007

By: Nobuyuki Higashi
Nobuyuki HIGASHI

Reference Figure 1



Reference Figure 2

	NO.	COMPONENTS (%)								CRETICAL UPSETTING RATIO(%)
		Si	Fe	Cu	Ti	Mn	Mg	Cr	Zn	
COMPARATIVE EXAMPLE	11	3.85	0.28	0.15	0.03	0.16	0.51	0.15	0.01	40.6
	12	4.96	0.29	0.16	0.04	0.24	0.61	0.14	0.00	39.4
	13	3.97	1.06	0.14	0.03	0.20	0.62	0.10	0.01	38.6
	14	4.17	0.29	0.96	0.03	0.18	0.58	0.10	0.01	40.3
	15	4.59	0.30	0.15	0.03	0.11	0.60	0.10	0.01	38.9
	16	4.04	0.30	0.15	0.03	0.19	0.40	0.15	0.01	40.1
	17	4.52	0.29	0.16	0.04	0.18	0.40	0.15	0.01	40.6
	18	4.98	0.28	0.15	0.03	0.20	0.41	0.10	0.01	39.6

Reference Figure 2

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COMPARATIVE EXAMPLE	11	3.85	0.28	0.15	0.03	0.16	0.51	0.15	0.01	40.6
	12	4.96	0.29	0.16	0.04	0.24	0.61	0.14	0.00	39.4
	13	3.97	1.06	0.14	0.03	0.20	0.62	0.10	0.01	38.6
	14	4.17	0.29	0.96	0.03	0.18	0.58	0.10	0.01	40.3
	15	4.59	0.30	0.15	0.03	0.11	0.60	0.10	0.01	38.9
	16	4.04	0.30	0.15	0.03	0.19	0.40	0.15	0.01	40.1
	17	4.52	0.29	0.16	0.04	0.18	0.40	0.15	0.01	40.6
	18	4.98	0.28	0.15	0.03	0.20	0.41	0.10	0.01	39.6